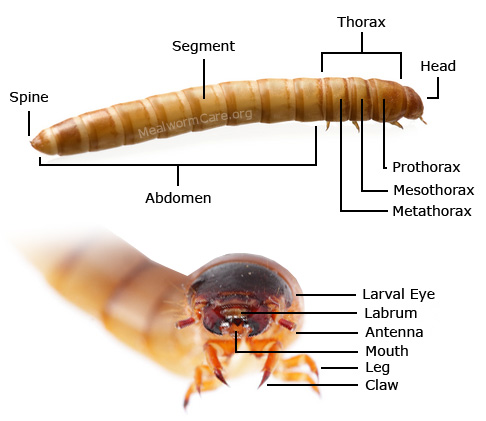
Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period: \_\_\_\_\_\_

**Animal Behavior Lab**

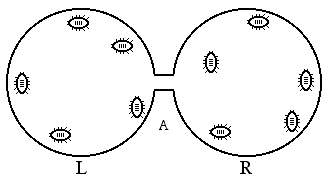
AP Biology 2015-2016

**Background Information:** *(thank you to mealwormcare.org)*

Mealworms are the brown worm-like larvae of darkling beetles. They are the second of four stages of life and exist to eat and grow until they have enough energy stored to begin transformation into pupae and then beetles.

Mealworms can be found throughout most of the world where they prefer warm, dark, and damp places like under decaying logs and leaves. They are designed for burrowing and eating and will feast upon grains, vegetation, spoiled food, and many other types of fresh or decaying organic matter.

These insects are an important part of the ecosystem. Their voracious eating habits aid in the decomposition and cleanup of unwanted organic matter. They are also an important food source for many animals. In the wild, birds, spiders, rodents, reptiles, and other insects prey upon them. Unfortunately, their eating habits and affinity for grains also make them pests in the modern world. Mealworms can get into and ruin stored flour, pet food, mill feed, cereal and other dry goods.

**Procedures for Experiment #1 – Initial Choice Chamber Experiment**

In this lab, you will be investigating the environmental preferences (wet or dry) of mealworms. You will create a “choice chamber” where one side of the petri dish contains wet filter paper and the other side contains dry filter paper. You will place 10 mealworms in the passageway of the choice chamber at the start of the experiment and record the number of mealworms on each side of the chamber every minute for 20 minutes.

For this experiment, we will be attempting to reject or fail to reject (support) the **null hypothesis**, which says “There is no statistically significant difference between the average number of worms on the wet and dry sides over the 20 minutes.”

If we reject the null hypothesis, we are supporting our **alternate hypothesis**. Please complete the alternate hypothesis below based on what you know about the normal habitat (wet or dry) of mealworms.

‘If mealworms are given a choice between a wet and dry environment, they will choose a \_\_\_\_\_\_\_\_ environment, resulting in an average number of worms on the \_\_\_\_\_\_\_\_ side that is significantly higher than the average number of worms on the \_\_\_\_\_\_\_ side over the 20 minutes.”

After collecting our data, we will use a statistical test called a Chi Square test to determine whether we should reject or fail to reject (support) our null hypothesis.

**Data:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Time (in minutes)** | **# of Worms on Wet Side** | **# of Worms on Dry Side** | **Additional Observations** |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |
| 6 |  |  |  |
| 7 |  |  |  |
| 8 |  |  |  |
| 9 |  |  |  |
| 10 |  |  |  |
| 11 |  |  |  |
| 12 |  |  |  |
| 13 |  |  |  |
| 14 |  |  |  |
| 15 |  |  |  |
| 16 |  |  |  |
| 17 |  |  |  |
| 18 |  |  |  |
| 19 |  |  |  |
| 20 |  |  |  |
| Group Mean (Average… round to the nearest tenth) |  |  |  |
| Class Sum of Means (whole number) |  |  |  |

**Analysis:** We are going to use a Chi square (X2) test to determine if our observed results match with our expected results (i.e. if our observed results match with what we would expect if the worms did not display a preference between wet and dry environments)

***How do I perform a Chi square test?***

1. ***State the null hypothesis***

* In this case, our null hypothesis says that “There is no statistically significant difference between the average number of worms on the wet and dry sides over the 20 minutes.”

1. ***Determine your expected values***

* If we started with 80 worms (10 worms per group x 8 groups) and there is no difference between the number of worms on the wet and dry sides, we would expect there to be \_\_\_\_\_\_ worms on the wet side and \_\_\_\_\_\_ worms on the dry side.

***3. Calculate chi2***

* The formula is:
* Where o = observed value, e = expected value, and ∑ = the sum of
* So you would need to calculate separately for each value (ex: worms on wet side vs. worms on the dry side) and then add the results together
* Show your calculation for the chi square value below

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Environment** | **Observed Value (Average)** | **Expected Value** | **Show your calculation** | **Chi square value (answer from the previous column)** |
| Wet |  |  |  |  |
| Dry |  |  |  |  |
| **Sum of your Chi square values** | | | |  |

***4. You will also need to know the degrees of freedom.***

* This is calculated using the formula (n-1)
* where n = the number of sets of results.(ex: the number of environments to choose from)
* How many degrees of freedom do we have for this experiment? \_\_\_\_\_\_\_

***5. Compare the X2 value against a table of critical values.***

* On the table below, refer to the row that corresponds to the correct number of degrees of freedom for your data set
* Look up the critical number at the p = 0.05 level. “p” stands for probability

**6. Make a conclusion**

* If the X2 value that you calculated in Step 3 is higher than the critical number at the p = 0.05 level then you can reject the null hypothesis. In other words, there is a statistically significant difference between the observed and expected results. (i.e. the observed results do not match the expected results)

*\*Note: A high X2 value corresponds with a low p value (below 0.05)*

* If the X2 value is less than the critical number then you fail to reject the null hypothesis. In other words, there is no statistically significant difference between the observed and expected results. (i.e. the observed results match the expected results)

*\*Note: A low X2 value corresponds with a high p value (above 0.05)*

**Rubric for Conclusion Paragraph** *(please break your paragraph down into the lettered parts identified below)*

|  |  |
| --- | --- |
| **Requirement** | **Points Received** |
| A) Identify your observed values (class sum of means). | /1 |
| B) Identify your expected values and explain how you calculated these values. | /2 |
| C) Identify your calculated Chi square value. | /1 |
| D) Identify your critical value and EXPLAIN how you obtained this value using the critical values chart. | /2 |
| E) Compare your Chi square value to the critical value (i.e., is it higher or lower than the critical value?), and draw an associated conclusion (i.e. do you reject or fail to reject your null hypothesis).  *\*\*\*Remember: Failing to reject your null hypothesis means you are supporting your null hypothesis\*\*\** | /2 |
| 2) Explain what it means to reject or fail to reject (support) your null hypothesis for this experiment. To do this, you must answer the following questions:   * Was there a statistically significant difference between your observed results and the expected results from the null hypothesis? * Does the data indicate that the mealworms may display an environmental preference? If so, what environment do they prefer? | /2 |

**Total Points: \_\_\_\_\_/10**